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Understanding Predictability and Model Errors through Light, Portable Pseudo-Assimilation and Experimental Prediction Techniques

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LONG-TERM GOALS

1. Develop a highly discriminating holistic diagnostic set, based on pseudo-assimilation (nudging), and test its efficacy using a matrix of several models and several reanalyses.
2. Exploit the above diagnostics for model development or calibration.
3. Illuminate global predictability pathways using the same toolkit.

OBJECTIVES

Obtain multiple target analyses in common format and multiple GCMs of a range of complexities. Nudge the GCMs to the reanalyses, carefully recording the 4D dataset of nudging tendencies. Interpret and exploit that dataset for the project's goals.

APPROACH

Since the point of multiple models is merely to bracket and baseline the uncertaintites and challenges at this stage, we are beginning with the most-convenient models, and the widest range of model types: CAM5, and a dry dynamical core with no physical tendencies at all which will be bias-corrected and fitted with a novel 'anomaly convection scheme' based on a matrix derived from cloud resolving models. At this stage we are studying a single 3-month time period, JJA 2008, part of the YOTC field campaign. Later the time window of study can be expanded or moved easily.

WORK COMPLETED

First runs of these two models under nudging have been obtained by postdoc Dr. Patrick Kelly, and initial studies of the nudging tendencies have been presented at conferences including the ONR program review. The anomaly convection scheme is being prepared fo the dry model by my senior PhD student, Siwon Song. A web site and data repository (whose long URL has been shortened to a bit.ly as above for convenience) have been set up, to host the matrix of results (many models x many reanalyses). We will press these forward through to their presentable results phase. Meanwhile, more gradually, we are working to expand the pool of models participating-- either by porting now models ourselves, or by convincing other modeling groups to run experiments and contribute data to our repository, based on the interestingenss of our analysis products and initial showcase results.

RESULTS

For CAM5, a dataset of analysis tendencies (ATs, which can be interpreted as "missing physics" or "physics errors") has been produced and plotted. One early insight is that the ATs do not resemble the simple negation of the climate biases. This means the climate biases involve compound errors, errors conditioned on other errors. One cannot guess the physics errors from the shape of the resulting biases.

For the dry model (with advected humidity scalar), a GCM with the grossest possible physics errors, we have devised a time-independent set of forcings that give the model a realistic climatology, by taking the time mean of the nudging tendencies (ATs) from a nudged run. It is perhaps surprising that bias correction works in a model with such a gross physics error (no physics at all). This is an ideal platform for understanding the impact of convection on predictability, in a clean linearized idealization and will be a new tier on the hierarchy of ,odels we use to understand the tropics.

IMPACT/APPLICATIONS

Informing model development is our highest goal, leading to better models.

RELATED PROJECTS

None yet.